CUTEC News

POWER SYSTEMS ANALYSIS IN GOSLAR

EDITORIAL

RESEARCH ON THE RIGHT SCALE!

Dear Readers,

The energy transition and the raw material transition create challenges which need to be overcome on the road to the sustainable industrial society. We are talking here about the migration from non-renewable, fossil-based energy and mineral-based resources to renewable energy and raw materials as well as recycled minerals and metals. It is going to take an enormous R&D effort to make this transition a reality. As soon as development moves beyond the realm of basic lab-scale university research, we become involved. We are the point of contact when the time comes to do things on a larger scale. We conduct XXL-size research, bridging the gap between lab development and industrial production. Our team has a broad range of expertise and skills. We also have a unique assortment of pilot-scale equipment. Both are needed to carry out projects of this nature. The list of equipment includes the zinc recycling demonstration system which won the 2012 German Raw Material Efficiency Prize, the biogas system, reactors for thermal conversion, the pyrolysis rotary kiln and the Fischer-Tropsch system for generation of high-grade hydrocarbons from syngas, to name just a few. As you can see, our experimental capabilities cover a large bandwidth and they are there for you to use either as a partner in a joint national or European-level R&D project or as a project initiator. Energy and resource efficiency as well as innovative energy conversion technology such as fuel cells and chemical energy storage systems are familiar ground to us. Experience stretching back many years along with an extensive range of equipment and systems makes our institute unique. You can take us at our word.

Best regards from the CUTEC team.
Yours sincerely,

Stefan Vodegel
Head of the Department of Thermal Process Technology and CUTEC Technical Director

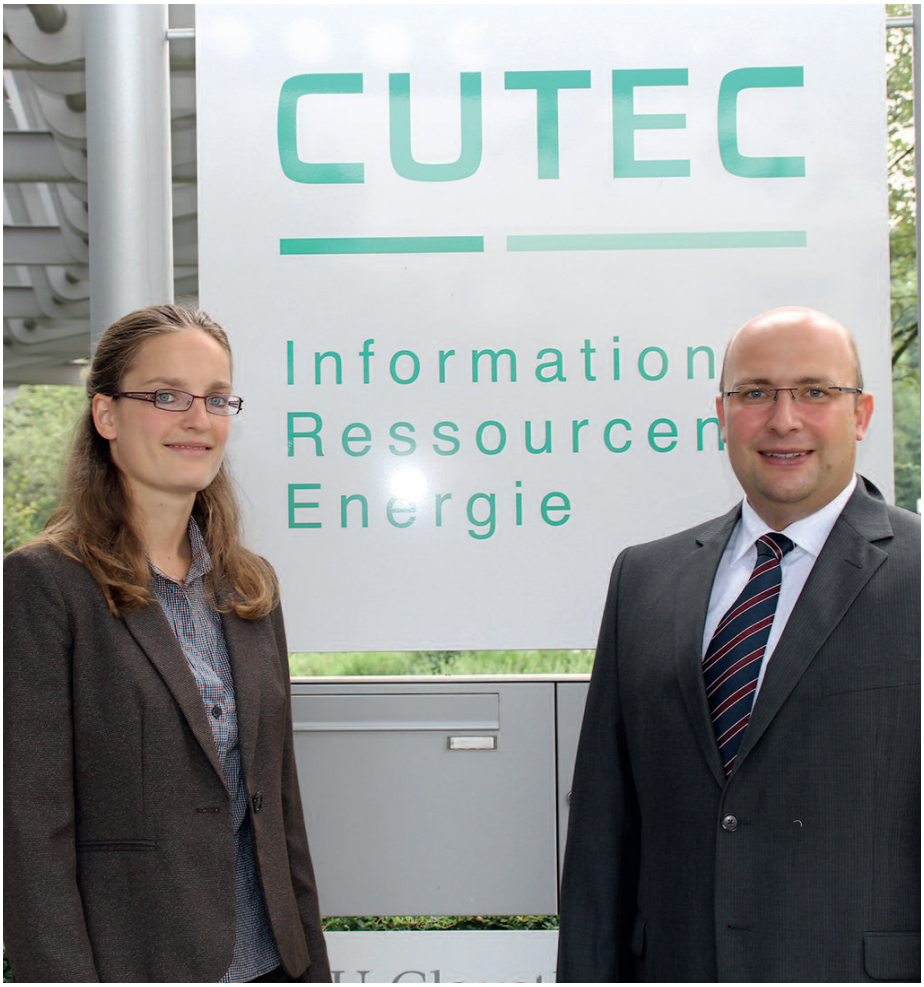
NEW POWER SYSTEMS ANALYSIS DEPARTMENT AT CUTEC

Research priorities

- System integration – power generation, grids, storage and consumption
- Systems for electric power, heat, transport and industrial processes from renewable sources
- Energy scenarios for local and regional government and industry

Vision

- Electricity Market Design 2050
- Operation and cost optimised deployment of storage systems and grids
- Energy supply for primary industry
- Intensification of the partnership with the Lower Saxony Energy Research Centre (EFZN)



Ann Kruse (M. Sc.) and Dr. Jens zum Hingst in front of the CUTEC Institute

In order to make the sustainable industrial society a reality, a science-based system analysis that delivers a reliable base of information is essential.

The role of the Power Systems Analysis Department in the information domain at CUTEC is to develop scientific models and generate scenarios for the complete shift of electricity, heat, transport and industry to renewable energy sources. Because the department is located at the Energy Research Centre (EFZN) in Goslar, it can link into local networks with the five universities in Lower Saxony which work together at EFZN and carry out joint energy-related projects.

The department's research priorities are aligned with the requirements of future power systems and the need for system integration of power generation, grids, storage and consumption. Particular emphasis is placed on renewabe electricity and heat supply systems and the supply of energy and basic materials for industry and transport. In addition to scenarios for total reliance on renewable sources, the progressive transition from central to distributed, renewable-dominated energy supply is also a priority for the recently established department. The goal is to create power scenarios at various levels (e.g. state, local community, sectors of industry, etc.).

In the years ahead, the Power Systems Analysis Department will contribute to the future structure of the electricity market (e.g. Electricity Market Design 2050).

Technical and economic research is another priority for the Power Systems Analysis Department. Major emphasis will be given to the design, expansion and deployment of storage systems and grids which are optimised from the operational and cost standpoint. Besides the needs of the power generation industry, primary industry is another application which is within the department's research agenda. A number of scenarios for meeting demand for energy and basic materials during the transition to the sustainable industrial society will be studied and analysed.

Intensified partnerships with the Lower Saxony Energy Research Centre (EFZN) and academic membership in the Clausthal University of Technology (CUT) Institute of Electrical and Environmental Power Engineering will be a useful resource for the department's scientific activities.

The real work at the new Power Systems Analysis Department was launched on August 1st, 2013 at the Lower Saxony Energy Research Centre.

Research Assistant Ann Kruse and Department Manager Dr. Jens zum Hingst are currently the two members of the department. (zh)

CONVERSION OF WASTE COLLECTION LOGISTICS TO ELECTRIC POWER USING SELF-GENERATED ELECTRICITY

Terms of reference

- Utilise surplus electricity from a waste-fuelled combined heat and power (CHP) power station to reduce fuel costs
- Technical and economic assessment of conversion of refuse collection vehicles to electric or hybrid drive
- Creation of infrastructure for vehicle loading
- Re-planning of waste collection

Despite all the efforts to increase energy efficiency, the earnings which waste-fuelled CHP stations are able to generate from supplying electricity have been on the decline for years. Things have now reached the point where it makes sense for the power stations to use more of the electricity themselves. Through its affiliation with BEG logistics, the Bremerhaven waste-fuelled CHP station is in the unusual situation of being able to use its surplus electricity to reduce fuel costs. In order to make this happen, the refuse collection vehicles would have to be converted from fossil fuels to electric drive or at least hybrid drive.

A concept study carried out on behalf of BEG logistics will create a project blueprint for utilising the electricity generated at the waste-powered CHP station in refuse collection logistics operations. The blueprint may also provide the basis for a model project. Suitable vehicles converted to electric drive and loading systems compatible with a waste-powered CHP station under parameters to be defined have to be available. A technical evaluation of conversion including the effects on logistics and power station operations will also be carried out. The cost effectiveness of the concept and the feasibility of running a model project will then be evaluated.

Hybrid drive and electric-only drive are the two future mobility options being considered. Heavy goods vehicles (HGV) are excluded due to range requirements and low power density. Waste collection vehicles on the other hand have a totally different logistics profile. They move at low speeds during collection rounds and are always driven to the same local destination (especially when a central waste-fuelled CHP station is involved). They are normally parked at a depot overnight and they can also be driven to a central charging or battery exchange station. Lower noise emissions from electric drive systems during the collection rounds in residential areas and a reduction in traffic emissions are additional aspects which are well worth to be considered.

Hybrid vehicles are already available on the market, for example the Faun ROTOPRESS Dual Power. The conventional diesel engine is used for longer journeys. During waste pick-up and refuse collection rounds, the vehicles switch to an electric motor which is powered by a small generator and battery buffer. An electric-only refuse collection vehicle is not currently available. Conversion is however feasible, and this technology is currently at the research stage.

The battery technology is also still under development. The power density and weight of the batteries are very important mobility parameters. Lead-acid batteries can be assumed to have a power/weight ratio of 45 Wh/kg - 50 Wh/kg. The current figure for li-ion batteries is approximately 100 Wh/kg, and metal hydride batteries are in roughly the same range (120 Wh/kg). The development goal is approximately 200 Wh/kg.

Assuming that a waste collection vehicle needs about 100 kWh of electrical energy for one collection round, based on the figures above the future on-board weight would be between 2,000 kg (lead-acid batteries) and 1,000 kg (li-ion) or possibly only 500 kg.

A typical waste-fuelled CHP station is able to supply a sufficient amount of electric power for that purpose. An initial estimate indicates that based on the figures above enough electricity would be available to charge approx. 1,000 vehicles. Further details of the charging systems still have to be defined (electrical power, work, dynamic behaviour). Rapid charging technology and battery exchange systems are the possible alternatives.

The expectation is that a total package which includes conversion, charging infrastructure, batteries and other requirements will not yet be cost-effective. An economic assessment and total eco-balance for this new approach are not yet available at the detailed level.

Based on the results of a concept study which is currently being carried out by the CUTEC Institute, a project outline will be submitted to the Ministry of the Environment for a consortium project involving the CUTEC Institute, the Lower Saxony Energy Research Centre and BEG logistics. (zh)

Will our waste collection vehicles have hybrid drive in the future?

IMPORTANT VISITORS AT CUTEC

VISIT FROM THE INTERNATIONAL PUBLISHER SPRINGER

Members of the management team at the international publisher Springer paid a visit to the CUTEC Institute at the beginning of July and were the guests of Prof. Faulstich.

Springer Science, which publishes 2,000 journals and 7,000 new books each year, is also one of the largest science publishers. Managing Director Dr. Birkelbach was accompanied by Mrs Ehl, Project Manager for Energy&Environment, and Mr Harms who is in charge of the Building/Energy/Environment book portfolio. The purpose of the visit was to discuss new joint print and online projects. One of the projects involves the use of the online Springer for Professionals portal to which CUTEC now has access. This digital reference library provides direct access to thousands of reference works and a large selection of professional journals published by Springer. Users who read general summary articles can find more detailed articles in the library.

The visit ended with a tour of the Test Centre which gave the visitors an insight into CUTEC's main research activities. The guests were visibly impressed with the sheer size of the equipment at the Institute, particularly the dezincing unit.

There was a general consensus among everyone involved in the visit that the collaborative relationship should be maintained and possibly even intensified in the future. (ro)

Visit from international publisher Springer at CUTEC (from the left): Mrs Ehl, Prof. Faulstich, Dr. Birkelbach, Dr. Roth and Mr Harms

MINISTER OLAF LIES HIGHLY IMPRESSED WITH REGIONAL RECYCLING CONCEPT

Lower Saxony Minister of Economics Olaf Lies accompanied by an SPD delegation visited CUTEC on July 24th 2013 (the SPD is a German political party). The visitors came to learn more about recycling of economically strategic metals. Information about the REWIMET recycling cluster for economically strategic metals and the impressive level of expertise already available was presented by experts from CUTEC, the Steering Committee, CUT (Clausthal University of Technology), the business community and Goslar County. The cluster is the only consortium of its kind in Germany.

Against this background, Prof. Faulstich started off by outlining the new structure of the CUTEC Institute which is focused on the development of a "sustainable industrial society". Dr. Westphal, Prof. Goldmann and Dr. Sieverdingbeck reported on the structure and activities of REWIMET, which has its roots in the "Future for Harz Initiative". Its membership includes CUTEC, CUT and 28 business entities, trade associations and local authorities. Dr. Zeller, head of the Metal Recycling Department, then explained the zinc recycling unit at the CUTEC Test Centre, which is the result of a German Ministry of Education and Research project. The unit was awarded the 2012 German Raw Material Efficiency Prize by the German Ministry of Economics, and it is regarded as a model research project.

The REWIMET consortium launched the Secondary Raw Material Centre project to strengthen the position of South-eastern Lower Saxony as a business location. The plan is to set up this Centre on the Recylex company site in Oker. It will carry out process development with the goal of eliminating technology gaps in metal recycling. The results are intended for direct industrial implementation. The Centre is expected to create jobs and further strengthen metal recycling expertise in the region.

The Minister was highly impressed with the current strategies, wealth of expertise and strong local networking among REWIMET members. He is convinced that support for regional activities can provide a sound basis for sustained development which will benefit Lower Saxony and Germany. The Minister welcomed the ground-breaking recycling initiative and made a commitment to support implementation of the ambitious project (total cost approx. 6.3 million euros). kra)

Prof. Faulstich talking with Lower Saxony Economics Minister Olaf Lies and SPD State MP Petra Emmerich-Kopatsch

SUNRAYSIA INSTITUTE AT THE CUTEC INSTITUTE

Stan Pietsch from the Sunraysia Institute in Australia visited CUTEC on June 10 - 11, 2013. In the Wastewater Engineering Department, he learned more about the current state of biogas generation in Germany. On behalf of the International Specialised Skills Institute, an Australian organisation which promotes technology development in the country, Stan spent several weeks in Europe on a fact-finding mission. The main purpose of the trip was to search for adapted, sustainable processing and utilisation strategies for effluent and solid manure from the Australian livestock farming industry. He was particularly interested in innovative approaches to nutrient recycling and the reduction of fresh water consumption. While he was at CUTEC and during his visits to a number of biogas plants, he became acquainted with many potentially useful process designs and made contacts which may lead to future collaboration. (bo)

REVIEW OF THE SUMMER FESTIVAL ON JUNE 13TH, 2013

Prof. Faulstich welcomes the guests at the first CUTEC Summer Festival

The first Summer Festival during the tenure of new Managing Director Prof. Faulstich had a lot to offer. It started at 3 P.M. with a few words of welcome to the guests and Institute staff from the event host. The Mayor of the Oberharz District Council Walter Lampe and CUT President Prof. Thomas Hanschke then each gave a short address. With reference to the many politicians who have visited the Institute since it was founded, Lampe stated that it is important for officials in the state capital to understand what is going on in Clausthal and what is needed there. Prof.

After the speeches and presentations, there was an opportunity to engage in technical discussions …

Hanschke expressed his satisfaction that Clausthal was able to successfully compete with TUM and recruit Prof. Faulstich.

Prof. Faulstich then outlined the future horizons for CUTEC in the context of the challenges created by the sustainable industrial society and the energy transition. He explained the new organisational structure. The Institute has six operating departments organised in pairs in the information, resource and energy technology domains. He explained the future research priorities, identified the energy transition as a core field of research and presented the re-designed homepage to the guests. The slides used during the presentations by the operational department managers featured the layout of the new corporate design. The department managers had 15 minutes to present their research priorities, their teams and 3 current projects. Those who were interested then had the opportunity to tour the Test Centre. “Refreshments” were served at 6 P.M. and the

… and cultivate long-standing contacts

event continued in a pleasant social atmosphere on the Institute grounds. The rain held off until late in the evening when many people who were outside took shelter in the tent.

In the run-up to the Festival and on the day, many members of the CUTEC team were busy playing their part. Looking back, we can now say with a bit of pride and without exaggeration that the first Summer Festival was indeed a big success. Once again, we would like to extend our thanks to everyone involved for their contribution. We would also like to thank our guests who also helped make the Summer Festival a memorable experience.

Here is a bit of news which may make anyone who was unable to attend this year’s event feel a bit better. Prof. Faulstich announced at the Festival that the event will be held again next year. So save the date – June 12th, 2014. You are cordially invited to be our guest on that day next year. (he)

ARTICLE ON THE SOAM PROJECT APPEARS IN THE NEWSPAPER

Contact with a Goslar newspaper (GZ) was made during a conversation at CeBIT 2013 between Prof. Reuter and Werner Beckmann, the author of a full-page article which appeared in the newspaper on June 22nd, 2013.

The article contains a report on the SOAM Project which is being carried out by the Model-Based Systems Analysis Department to detect and classify dumped World War I and II era munitions and chemical weapons in the North Sea and the Baltic Sea. This topic has received a lot of attention recently, because some offshore wind parks could not be connected to the grid as planned following the discovery of dumped munitions on the sea floor.

To increase public awareness of the issue and the associated risks, Beckmann approached Prof. Reuter who is the overall Project Coordinator to obtain information for his readers from a first-hand source. (re)

NEW PROJECT TO OPTIMISE ENERGY CONSUMPTION AND PROCESS MANAGEMENT AT AN ICE CREAM FACTORY

During industrial production of ice cream substantial amounts of electricity, natural gas and cooling power are consumed. Cooling can be provided by an electrical cooling system or from a stored coolant, i.e. cryogenic liquid nitrogen (-196 °C). The simultaneous need of electricity, heating and cooling creates an unusually favourable opportunity for deploying so-called combined heat, cooling and power (CHCP) technologies as means of an innovative, energy-efficient co-generation of power.

Participating in a project funded by the German Environment Foundation (DBU), CUTEC will join forces with the medium-size ice cream producer Bruno Gelato (http://www.bruno-eis.de) to identify opportunities for reducing the consumption of electricity, natural gas and cryogenic liquid nitrogen. The goal is to increase overall efficiency and reduce production-related CO_2 emissions. Therefore the project team will look, both, means of reducing the amount of energy used, and of increasing the contribution of renewable resources. The project is divided into three work packages. The first step is to identify and maximise opportunities for energy savings with the existing equipment and configuration.

The next step will be the evaluation of innovative, efficient CHCP techniques reducing the need for large amounts of (external) electricity and cooling power in ice cream production. In the final phase, the researchers will look for opportunities for utilising renewable energy (e.g. excess electricity from wind and photovoltaic generation).

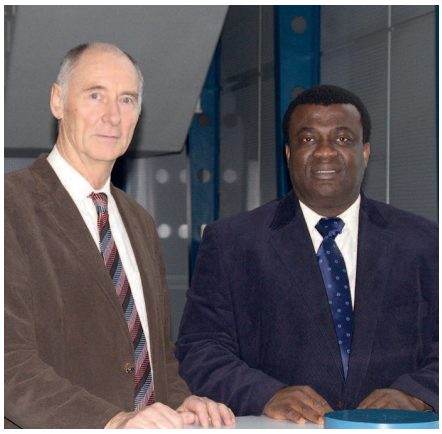
The results will be relevant not only to ice cream producers but also to all medium-size food producers applying a cryogenic shock freezing process. The Chemical Power Systems Department has the lead role in the project, which will run for 12 months and officially started on September 1st, 2013. (li)

Photo: http://www.bruno-eis.de

Bruno Gelato head office in Rhauderfehn

CUTEC AND EFZN PLAN JOINT SOLAR PROJECTS IN NIGERIA

The CUTEC Institute has been very active in Nigeria since 2006 working on environmental projects for some states including Abuja. Our long-standing presence in the country has now led to contact with the Nigerian government on renewable energy solutions. Most of Nigeria's electricity is generated by hydroelectric power, but there is not enough capacity to meet the country's electricity demands. Power outages are a frequent occurrence. The Nigerian President and his cabinet have decided that solar, wind power and biomass (renewables) will be used to generate additional power which is needed to make up for the shortfall. At the beginning of June, 2013 Minister of State Mrs. Zainab Kuchi from the Energy Ministry in Abuja invited Dr. Onyeche from CUTEC and Prof. Beck from the Lower Saxony Energy Research Centre (EFZN) to submit an initial outline for a solar project for Abua and Kaduna districts. German Deputy Ambassador Mr. Moemkes and Mr. Schulz from the Economic Section were also involved in the discussions in Abuja. As a result of the initial visit, it was decided that CUTEC and EFZN should conduct a preliminary project study to investigate the deployment of large photovoltaic power stations (in 100 megawatt range) to supplement existing hydroelectric power stations as well as insular photovoltaic/battery systems for rural electrification. A proposal for the preliminary study has been submitted and there is a high likelihood that the study will be carried out in the near future. At the end of June, 2013, Dr. Onyeche revisited Nigeria accompanied by Prof. Engel from the Technische Universität Braunschweig to present details of the preliminary study and hold discussions with the potential investors and key officers of the Power Ministry. There is good reason to believe that the project study will soon be commissioned. In that case, CUTEC will act as project coordinator and provide scientific support for the project in conjunction with EFZN. (on)



Prof. Beck (left), Lower Saxony Energy Research Centre, and Dr. Onyeche, CUTEC Institute

REPRESENTING CUTEC ON THE ROAD

FULDA SLUDGE CONFERENCE

The Sludge Conference was held for the 8th time in Fulda on June 4th - 6th, 2013. Once again on both days, this major event attracted more than 300 participants who attended the talks and visited the accompanying exhibition in order to stay abreast of current developments. They also took the opportunity to share information with their peers and the speakers. The conference was organised by the German Association for Water, Wastewater and Waste (DWA).

The main emphasis of this year's three-day conference was on current political, legal and process engineering developments in the field of sewage sludge treatment and disposal.

Two of the speakers were from CUTEC. On the first day following a few words of welcome and an introduction by Prof. Dichtl from the Technische Universität Braunschweig, Prof. Faulstich gave the opening talk entitled "Wastewater and sewage sludge: potential material resources for the future? Do we need to change mindsets?" On the following day in the Sludge Technologies 1 thematic block, Prof. Sievers who is in charge of the Wastewater Engineering Department gave a talk on the potential and the limitations of biodegradable conditioning agents.

Photo: DWA

Prof. Sievers at the rostrum during his talk

ESCHBORN SYMPOSIUM

Photo: GIZ/Ostermeier

Prof. Faulstich during his talk

Germany has a deficiency of natural resources and will remain dependent on a secure supply of metals, minerals and energy resources over the long term. Natural resources offer huge potential for sustainable development. However, increasing demand for natural resources also creates major challenges for the countries of origin.

400 international experts from government, industry, science and civil society got together to discuss the issues on June 18th - 19th. Speakers from around the world shared their experiences and took part in the debate with the guests. The list of speakers included Sheila Khama, former Chief Executive Officer of De Beers in Botswana, Mattia Pellegrini from the European Commission and Jonas Moberg from EITI (Extractive Industries Transparency Initiative). Speakers from various companies gave talks and took part in the discussions.

The key issues were: how should the natural resource base be exploited so that the benefits are shared with a broad segment of the population; where are national and international natural resources and natural resource policies reaching their limits; what role do companies play in the natural resource sector and how can competition for mineral resources, land and water be resolved in a fair and eco-friendly manner?

In theme Forum 5 (Future Sources of Raw Materials), Prof. Faulstich gave a keynote talk entitled "Resource Efficiency and Urban Mining: the Ideal Pathway to a Green Economy."

BERLIN ENERGY CONFERENCE

Distributed Energy Supply was the theme of the Berlin Energy Conference which was held on June 24th – 25th at the Seminaris Campus Hotel Berlin.

TK Verlag was responsible for organising the event. Prof. Karl J. Thomé-Kozmiensky from TK Verlag and Prof. Michael Beckmann from TU Dresden along with Dr. Thiel from vivis Consult GmbH acted as programme coordinators.

On the first day in the Strategies, Concepts and Economy Thematic Block, Prof. Faulstich gave a talk to around 100 experts entitled "Perspectives on the Future Energy Supply – Energy Policy Challenges on the Road to Total Regenerative Supply."

Also on the first day, there was a very intriguing panel discussion involving Professor Martin Faulstich, former Senator Dr. Fritz Vahrenholt (one of 2 authors of the book The Cold Sun - Why the Climate Crisis Isn't Happening) and Christoph Pieper from TU Dresden. The audience was very disappointed that the event ended much too early.

In the aftermath of the event, a report of the proceedings entitled "Distributed Energy Supply" will be published by Prof. Karl J. Thomé-Kozmiensky and Prof. Michael Beckmann.

Photo: Elisabeth Thomé-Kozmiensky

Shown in the photo: Prof. Thomé-Kozmiensky at the speaker's podium along with Prof. Vahrenholt, Prof. Faulstich and Mr Pieper (left to right) at the table

THE LATEST FROM THE CUTEC TEAM

Five new employees, one examination passed and a lectureship

Dr. Jens zum Hingst joined CUTEC as head of the new Power Systems Analysis Department on August 1st, 2013 (see article on Page 2).

He received his doctoral degree in Power Systems Engineering from CUT. The subject of his thesis was process-integrated simulation of medium-voltage electricity grids with distributed feed-in and incomplete measurement infrastructure. He worked as a research assistant in the Institute for Electrical Power Engineering at CUT from 2004 to 2009. He subsequently worked in project development at the Energy Research Centre (EFZN) in Goslar.

Ann Kruse joined CUTEC at the beginning of July. She too works in the Power Systems Analysis Department which is part of the information domain.

Ann completed a cooperative education course of studies in Business Economics, doing her practical work at IBB (Investitionsbank Berlin). She specialised in banking and received her B.A from the Berlin School of Economics and Law. She went on to obtain a Master's Degree in Technical Business Management at CUT. The subject of her thesis was critical raw materials.

Both have their offices at the Energy Research Centre (EFZN) in Goslar.

A new employee joined the Thermal Process Technology Department on August 1st. Angela Bethge obtained a degree in chemical engineering at CUT. She will be taking up her first post as research assistant at the CUTEC Institute. She will be heavily involved in research projects focusing on thermochemical conversion of renewable solid fuels.

Dr. Jens zum Hingst and Ann Kruse in the foyer at the CUTEC Institute

Jessica Hauck (left) and Angela Bethge

Working life also began "in earnest" for Jessica Hauck at CUTEC on August 1st. That Thursday was her first day of work in the CUTEC admin team. Over the coming three years, she will receive in-depth vocational training in office administration.

Katharina Bednarsky is not an unfamiliar face at the Institute. She completed a course of vocational training in office administration between 2009 and 2012. She subsequently worked as a secretary and in the admin section at CUT before returning to CUTEC on August 1st, 2013, where she will work in admin.

Katharina Bednarsky at work

Congratulations to

Alina Zech who passed her examinations and completed her vocational training in office administration in the summer. Once again, we would like to extend our thanks to her and wish her all the best for the future.

(he/wes)

Lectureship for Dr. Lindermeir at TUM

Dr. Andreas Lindermeir, head of the Chemical Power Systems Department at the CUTEC Institute, was offered a lectureship at TUM (Technische Universität München) during the summer semester 2013. On July 17th - 19th, he gave a lecture on process engineering which was slotted in as a module into the Environmental Engineering course. Around 120 students attended the compulsory lecture given in the TUM Raw Materials and Energy Technology Department under the direction of Prof. Wolfgang Mayer. The content covered the entire spectrum of basic engineering disciplines. Exercises on the various lecture topics were assigned to reinforce learning.

Dr. Lindermeir studied Chemical Engineering at CUT. He is a lecturer at HAWK Hildesheim / Holzminden / Göttingen and is involved in student education at CUT. (li)

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